NUTRITIONAL DISORDERS IN FRUIT CROPS

DIAGNOSIS AND MANAGEMENT



M. Prakash K. Balakrishnan A. Rathinasamy

Nutritional Disorder in Fruit Crops Diagnosis and Management

M. Prakash

Professor Faculty of Agriculture Annamalai University Annamalainagar – 608 002 Tamil Nadu

K. Balakrishnan

Professor of Crop Physiology Agricultural College & Research Institute Tamil Nadu Agricultural University Madurai – 625 104

A. Rathinasamy

Professor of Soil Science & Agricultural Chemistry
Horticultural College & Research Institute
Tamil Nadu Agricultural University
Periyakulam – 626 504
Tamil Nadu



NEW INDIA PUBLISHING AGENCY

New Delhi - 110 034



NEW INDIA PUBLISHING AGENCY

101, Vikas Surya Plaza, CU Block, LSC Market Pitam Pura, New Delhi 110 034, India

Phone: +91 (11)27 34 17 17 Fax: +91(11) 27 34 16 16

Email: info@nipabooks.com Web: www.nipabooks.com

Feedback at feedbacks@nipabooks.com

© Authors, 2013

ISBN: 978-93-81450-95-6

All rights reserved, no part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior written permission of the publisher or the copyright holder.

This book contains information obtained from authentic and highly regarded sources. Reasonable efforts have been made to publish reliable data and information, but the author/s, editor/s and publisher cannot assume responsibility for the validity of all materials or the consequences of their use. The author/s, editor/s and publisher have attempted to trace and acknowledge the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission and acknowledgements to publish in this form have not been taken. If any copyright material has not been acknowledged please write and let us know so we may rectify it, in subsequent reprints.

Trademark notice: Presentations, logos (the way they are written/presented), in this book are under the trademarks of the publisher and hence, if copied/resembled the copier will be prosecuted under the law

Composed, Designed and Printed in India

Contents

Preface	v
1. Concept of Plant Nutrition	1
1.1 Introduction	1
1.2 Essentiality of plant nutrients	
1.2.1. The criteria of essentiality of elements	
1.3 Clssification	
1.3.1. Based on the nutrient contents	2
1.3.2. Based on chemical nature and mobility of ions	
2. Principles of Diagnosis	5
2.1 Diagnosis and prognosis	5
2.2 Diagnostic tools	
2.3 Steps involved in diagnosis	
2.4 Diagnosing nutritional disorders	
2.5 Development of deficiency	7
3. Diagnostic Techniques	9
3.1. Use of Visual deficiency symptoms	9
3.1.1 Distribution of visible deficiency symptoms	
3.1.2 Remobilization of nutrient and distribution of deficiency	
symptoms	10
3.1.3 Distribution of nutrient deficiency symptoms in crops	13
3.2 Plant analysis	13
3.2.1 The Critical concentration	14
3.2.2 Plant sampling	15
3.2.3 Sample handling and preparation	
3.2.4 Laboratory analysis	
3.2.5 Interpretation of plant analysis	
3.3 Rapid tissue testing	
3.3.1 Collection of cell sap	
3.3.2 Collection of sample	
3.3.3 Advantages	

4. Deficiency Symptoms	23
4.1 Deficiency symptoms in different plant parts	23
4.1.1 Symptoms	
4.1.2 Whole plant	24
4.1.3 Leaves	25
4.1.4 Terminal shoots	26
4.1.5 Stem	26
4.1.6 Roots	27
4.1.7 Fruits	27
4.1.8 Seeds	28
4.1.9. Indicator fruit crops	28
4.2 Defeicency symptoms of nutrient element	29
4.2.1 Nitrogen	29
4.2.2 Phosphorus	39
4.2.3 Potassium	50
4.2.4 Calcium	60
4.2.5 Magnesium	68
4.2.6 Sulphur	75
4.2.7 Zinc	80
4.2.8 Copper	88
4.2.9 Iron	96
4.2.10. Manganese	102
4.2.11 Boron	110
4.2.12 Molybdenum	121
5. Management of Nutritional Disorders	127
5.1 Foliar nutrition of fruit crops	127
5.1.1 Situations needed for foliar fertilization	
5.1.2 Conditions determining the feasibility of foliar fertilization	
5.1.3 Factors affecting foliar absorption	
5.1.4 Solution preparation	
5.1.5 Surfactants	
5.1.6 Time of spray	
5.1.7 pH of the nutrient solution	
5.1.8 Suggestions for effective spray application	
5.1.9 Merits of foliar application	
5. 1.10 Precautions during foliar fertilization	
5.2 Chelates	
5.2.1 Why chelates are effective?	135
5.2.2 Stability of chelates	
5.2.3 Methods of application	
5.2.4 Characteristics of a chelate applied as foliar spray	
5.2.5 Characteristics of a chelate applied to soil	
5.2.6 Practical considerations of chelates application	

References	
Colour Plates	163
3. Calculation of Fertilizer Requirement	153
2. Preparation of Solutions	151
1. Basic Information	145
6. Appendices	145
5.4.1 Method of application	143
5.4 Root feeding	
5.3.10 Salient findings in fruit crops	
5.3.9 Advantages of fertigation	
5.3.8 Fertigation scheduling	
5.3.7 Prerequisites for fertigation	
5.3.6 Preparation of solutions	
5.3.5 Fertigation equipment	
5.3.4 Suitability of nutrients	
5.3.3 Application methods	
5.3.2 Nutrient sources	
5.3.1 Types of fertilizers for fertigation	
5.3 Fertigation	



NUTRITIONAL DISORDERS IN FRUIT CROPS DIAGNOSIS AND MANAGEMENT

Readership: Students, faculties, researchers and progressive farmers in the field of fruit science, pathology, physiology, entomology.

Diagnosis involves careful observation of crop with a thorough knowledge of crop behaviour as well as a complete understanding of functions of nutrients and their deficiency symptoms. Diagnostic techniques vary from crop to crop depending upon the field condition in which the deficiency occurs. Indian agriculture has entered into an era of multiple nutrient deficiencies.

Realizing the gravity of emerging problem of nutrient deficiencies and to fulfill an immediate need to tackle them more efficiently, a guide on diagnosis of nutritional disorders and their corrections in crop plants has been prepared. All the new diagnostic techniques have been discussed in a simple language. The book has been designed in such a way as to improve the knowledge on diagnosis of deficiencies of mineral elements essential for normal plant growth, and of the methods by which such deficiencies may most effectively be remedied. The main feature of this book is the detailed description of the various visual deficiency symptoms exhibited by the fruit crops.

The book has been written primarily for the use of the students of Horticulture and Agriculture to help update their knowledge on nutritional and physiological disorders of fruit crops. It is also felt that the book will provide a suitable basis for those engaged in the profession of agriculture like extension workers and progressive farmers. We hope that this book will go a long way to help in increased fruit production by proper diagnosis and suitable correction of nutritional disorders in fruit crops.

M. Prakash: Professor, Faculty of Agriculture, Annamalai University, Annamalai nagar - 608 002, Tamil nadu

K. Balakrishnan: Professor of Crop Physiology, Agricultural College & Research Institute, Tamil Nadu Agricultural University, Madurai – 625 104, Tamil Nadu

A. Rathinasamy: Professor of Soil Science & Agricultural Chemistry, Horticultural College & Research Institute, Tamil Nadu Agricultural University, Periyakulam – 626 504, Tamil Nadu



NEW INDIA PUBLISHING AGENCY

101, Vikas Surya Plaza, CU Block, L.S.C.Market Pitam Pura, New Delhi-110 034, India

Tel.: +91(11) 27341717, Fax: +91(11) 27341616

E-mail: info@nipabooks.com Web: www.nipabooks.com

